

ATTACHMENT VI

CONCEPTUAL DESCRIPTION FOR THE SELECTED HIGH PM-10 DAYS

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Nomenclature

EPA	Environmental Protection Agency
MCAQD	Maricopa County Air Quality Department
NAAQS	National Ambient Air Quality Standards
NA	Nonattainment Area

1. Conceptual Description

This conceptual description follows EPA's *Guidance on the Use of Models and Other Analyses in Attainment Demonstrations for the 24-hour PM-10 NAAQS* and provides additional information on the Maricopa County PM-10 nonattainment problem.

1.1 Do violations of the NAAQS occur at several monitoring sites throughout the nonattainment area, or are they confined to one or a small number of sites in proximity to one another?

As shown in Figures 1~3., violations of the NAAQS occur at a limited number of sites throughout the PM-10 nonattainment area. Buckeye, Durango Complex, Higley, and West 43rd Avenue are the monitoring stations that had at least four PM-10 exceedances during the period January 2004 through March 2006[1]. The site with the highest number of exceedance days for each year is circled in blue.

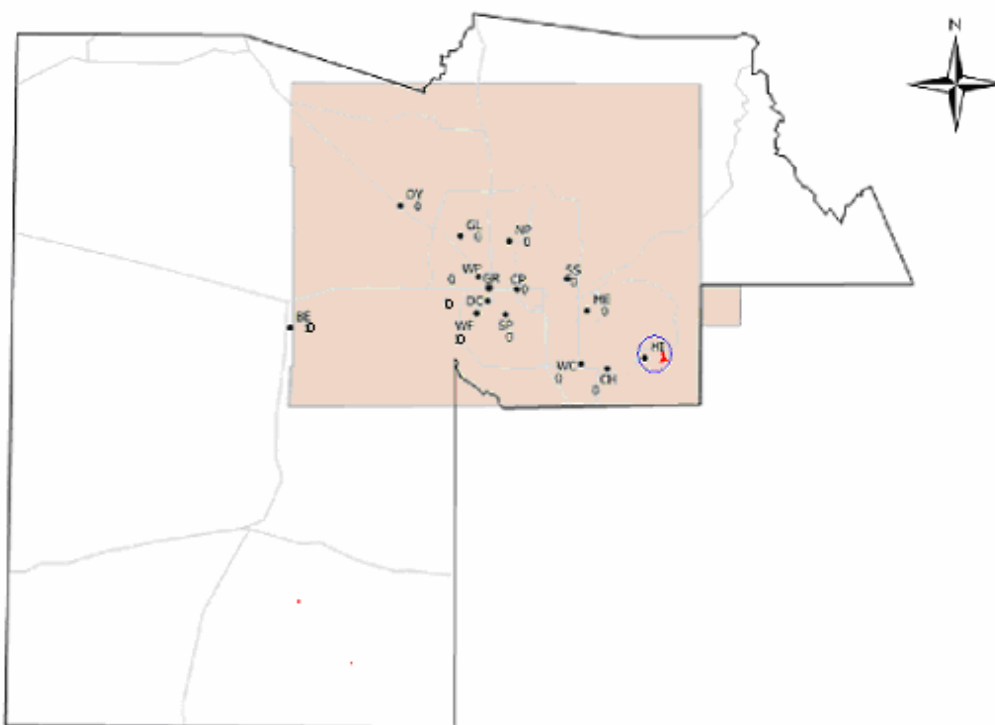


Figure 1. Spatial Distribution of 24-hour PM10 Exceedances in 2004[1]

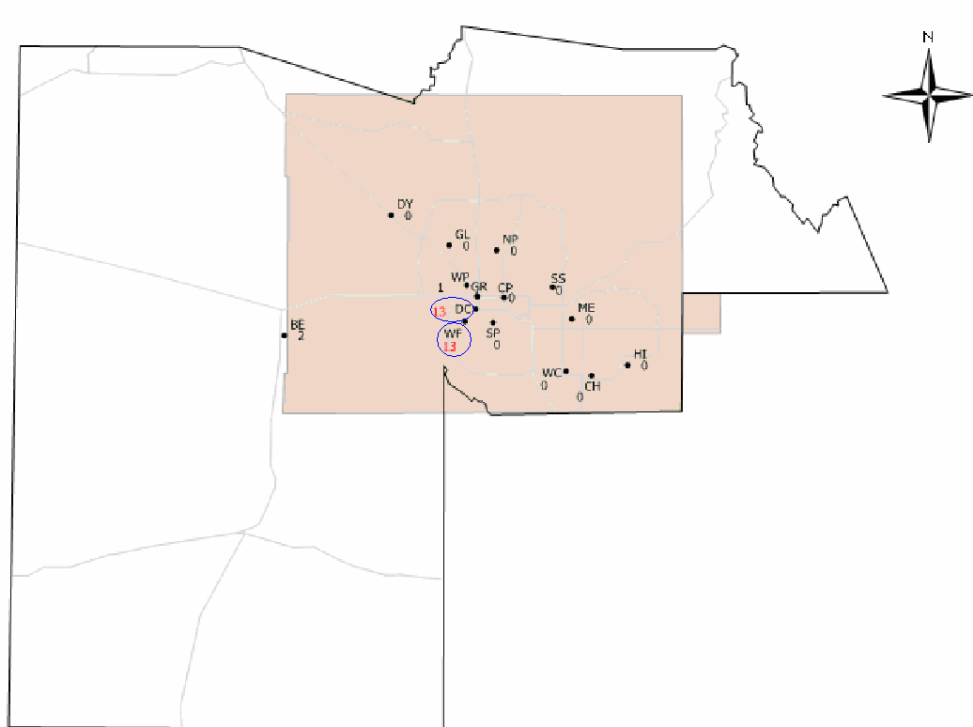
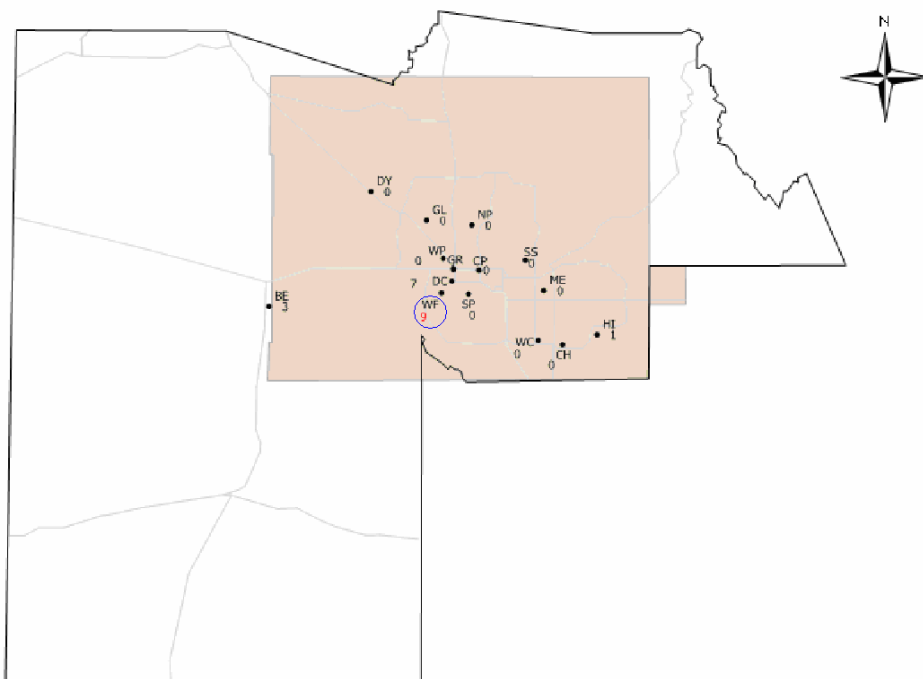


Figure 2. Spatial Distribution of 24-hour PM10 Exceedances in 2005[2]



Figures 3. Spatial Distribution of 24-hour PM10 Exceedances in 2006 (through March 2006)[3]

1.2 Do observed 24-hour average PM10 concentrations exceed 155 µg/m³ frequently or just on a few occasions?

The frequency of 24-hour PM-10 average exceedances varies among the monitors as shown in Table 1. The West 43rd Avenue and Durango Complex sites had the highest number of 24-hour PM-10 exceedances, 13 days, in 2005. It is important to note that the exceedances prior to 2005 were recorded at monitors that were sampled once every six days. Therefore, each of these exceedances represents an expected daily exceedance rate that is six times the value shown. All monitors that exceeded the standard in 2005, including West 43rd and Durango, have been converted to a daily sampling schedule.

Table 1. Number of Days Exceeding 154µg/m³ of 24-hour PM-10 Concentration [1,2]

24-Hour average greater than 154 ug/m ³								
City Location	2000	2001	2002	2003	2004	2005	2006*	Maximum
#Buckeye	-	-	-	-	-	2	3	3
Chandler	1	0	0	1	0	0	0	1
W. Chandler	0	0	0	2	0	0	0	2
#Dysart	-	-	-	0	0	0		
Glendale	0	0	0	0	0	0	0	0
Goodyear/Estrella	0	0	0	0	0	0	0	0
Higley	1	1	0	1	1	0	1	1
#Maryvale	1	0	0	0	0	Shutdown	-	1
Mesa	0	0	0	1	0	0	0	1
Palo Verde	0	0	0	1	0	0	0	1
Durango Complex	2	1	2	1	0	13	7	13
South Phoenix	1	0	0	1	0	0	0	1
W. 43 rd Ave.		Not operating	1	2	0	13	9	13
West Phoenix	0	0	0	1	0	1	1	1
#Salt River	6	6	2	Shutdown	-	-	-	6
Central Phoenix	0	0	0	0	0	0	0	0
North Phoenix	0	0	0	1	0	0	0	1
JLG Super Site	0	0	0	1	0	0	0	1
Greenwood	2	0	0	1	0	1	1	2
South Scottsdale	0	0	0	1	0	0	0	1
Tempe	0	0	0	0	0	0	0	1
#Surprise	0	0	0	Shutdown	-	-	-	0
Bethune Elementary	-	-	-	-	0	0		0

*Note: 2006 data is through March 2006 and has not been validated by MCAQD. Some of the days in 2006 may be flagged as natural events.

Maryvale (Closed 04/01/2004), Salt River (Closed in 2002), Surprise (Closed 7/15/03), Bethune Elementary School (Opened 10/19/2004), Buckeye (Opened 8/01/2004), and Dysart (Opened 7/16/03).

1.3 When 24-hour average PM-10 in excess of $154 \mu\text{g}/\text{m}^3$ occurs, is there an accompanying characteristic spatial pattern, or is there a variety of spatial patterns?

These patterns, grouped by the blue lines, are summarized in Figure 4.~7. Most exceedances occur at a small number of sites in proximity to one another in a partial region of the PM-10 nonattainment area [1,2].

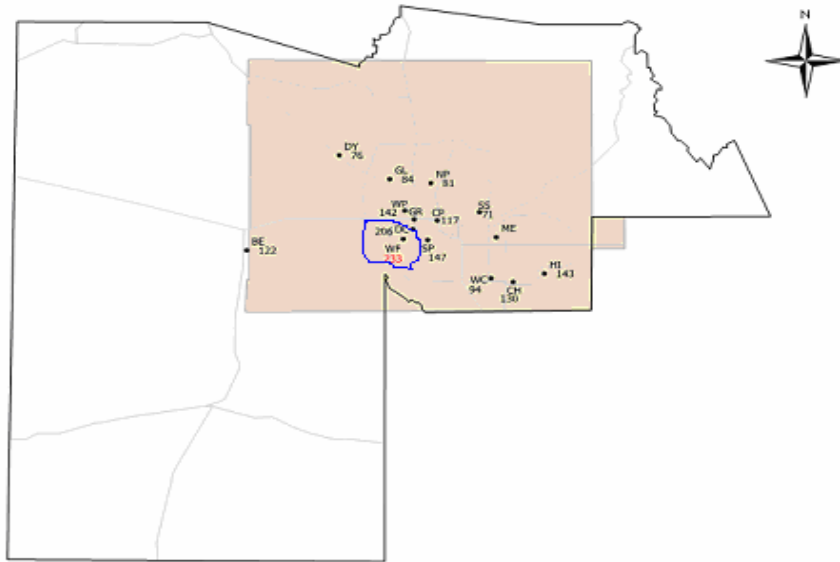


Figure 4. Spatial Patterns when 24-hour PM-10 Average in Excess of $154 \mu\text{g}/\text{m}^3$ Occurred on December 12, 2005

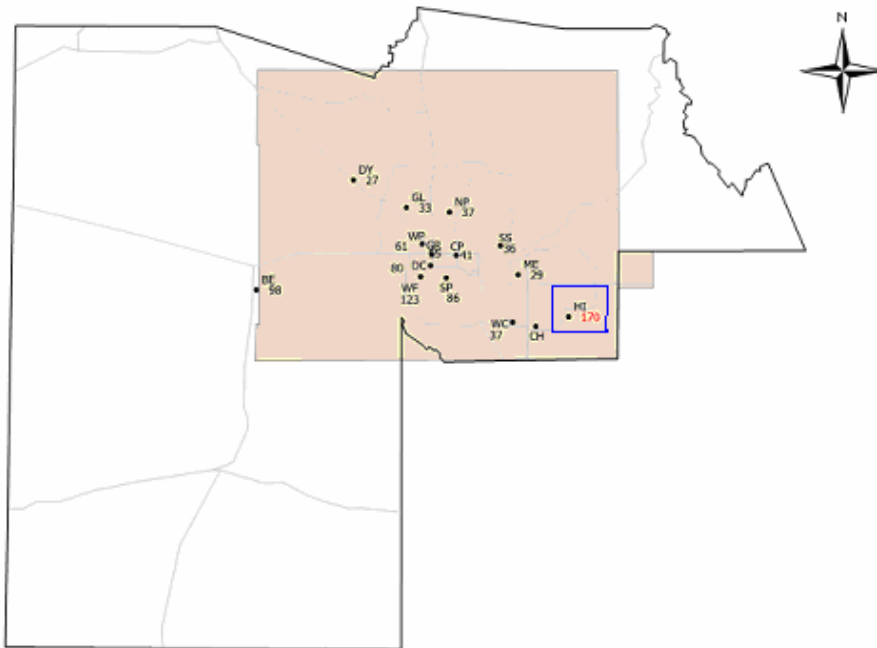


Figure 5. Spatial Patterns when 24-hour PM-10 Average in Excess of $154 \mu\text{g}/\text{m}^3$ Occurred on January 24, 2006

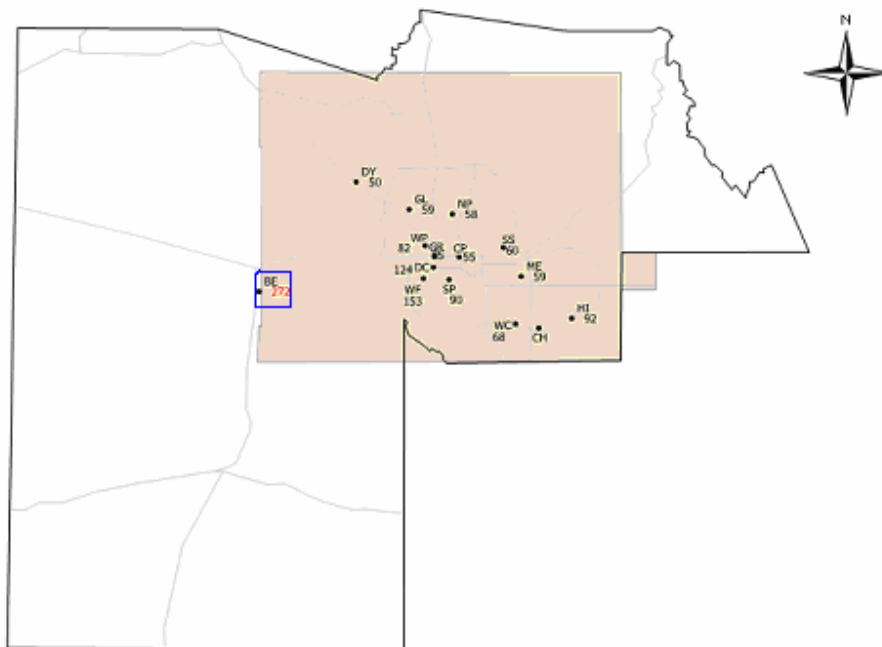


Figure 6. Spatial Patterns when 24-hour PM-10 Average in Excess of $154 \mu\text{g}/\text{m}^3$ Occurred on February 14, 2006 [3]

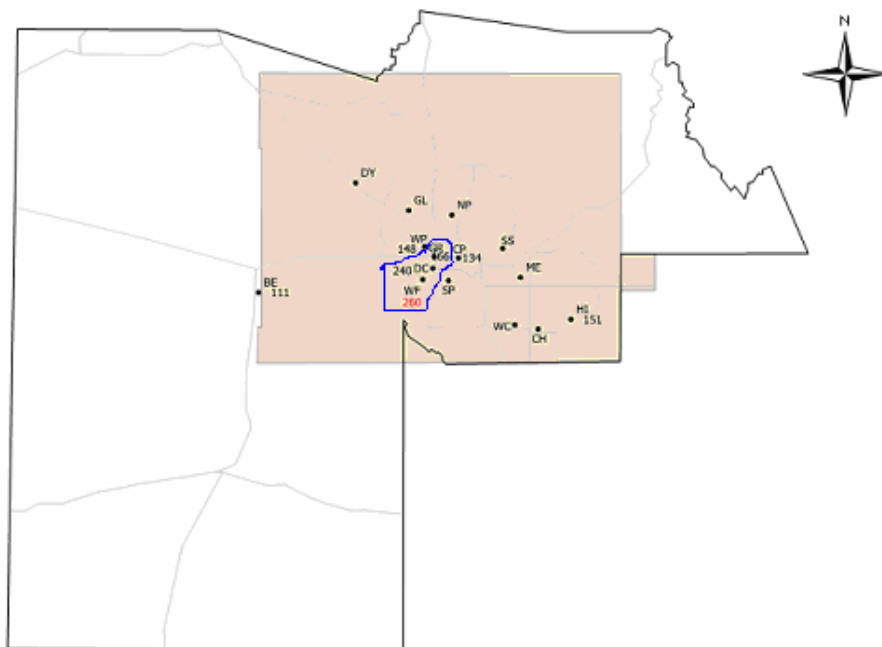


Figure 7. Spatial Patterns when 24-hour PM-10 Average in Excess of $154 \mu\text{g}/\text{m}^3$ Occurred on March 10, 2006 [3]

1.4 Do monitored violations occur at locations subject to mesoscale wind patterns which may differ from the general wind flow?

Hourly surface wind direction and wind speed data on high and low wind days at the West 43rd site are summarized in Figure 8. Morning winds are predominantly calm and afternoon winds are westerly on days with 24-hour PM-10 averages greater than 155 $\mu\text{g}/\text{m}^3$ (both low and high wind days). This is similar to low PM-10 days when afternoon winds are predominantly westerly. The PM-10 nonattainment area has apparent morning afternoon (westerly) wind patterns regardless of days with high or low PM-10 concentrations. Figures 8. to 9. show the wind roses for all of the PM-10 exceedance days (low wind) from March 2005 through March 2006. Figure 10. to 11. shows the wind roses for all of the PM-10 exceedance days (high wind) from March 2005 through March 2006. Figures 12. to 13. show the wind roses for all of the PM-10 non-exceedance days from March 2005 through March 2006.

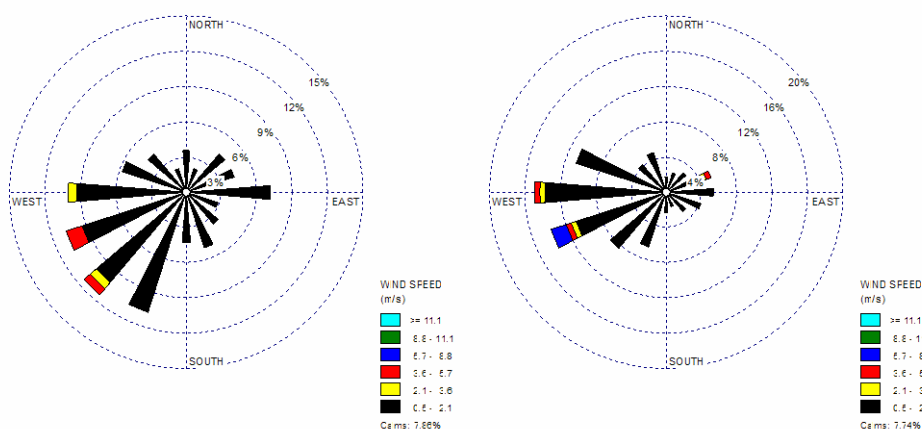


Figure 8. Wind Roses for Low Wind PM-10 Exceedance Days (March 2005- March 2006) at West 43rd site: 0:00-04:00 (left) and 05:00-10:00 (right)

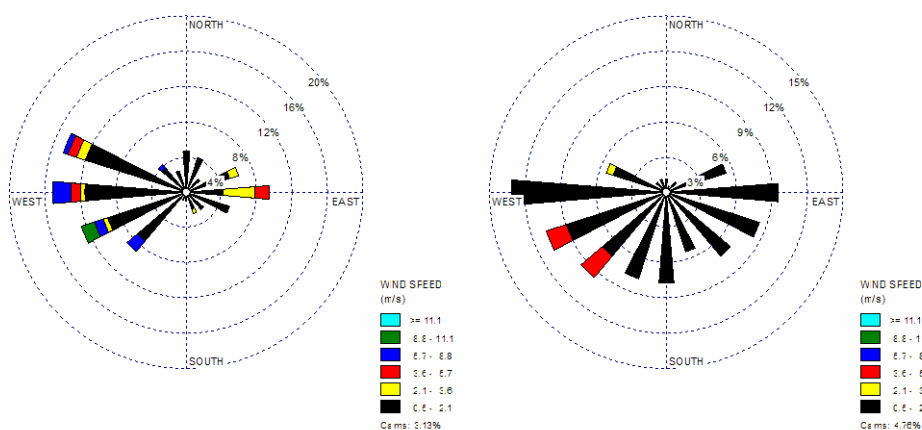


Figure 9. Wind Roses for Low Wind PM-10 Exceedance Days (March 2005- March 2006) at West 43rd site: 11:00-17:00 (left) and 18:00-23:00 (right)

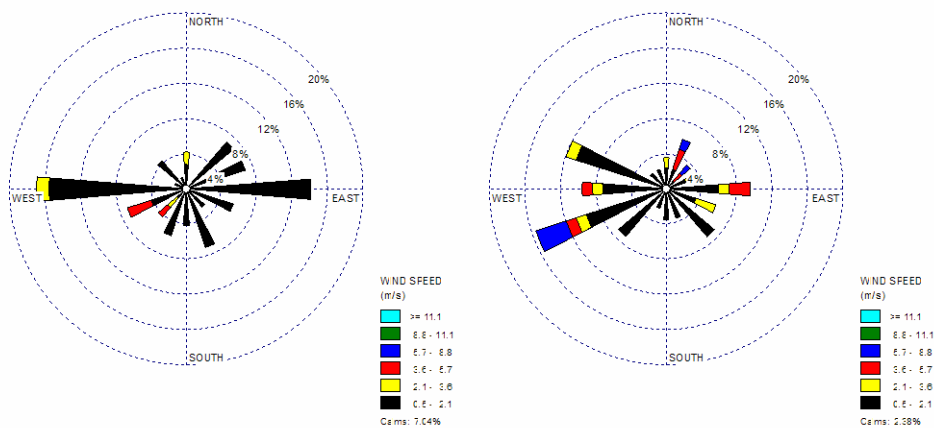


Figure 10. Wind Roses for High Wind PM-10 Exceedance Days (March 2005- March 2006) at West 43rd site: 0:00-04:00 (left) and 05:00-10:00 (right)

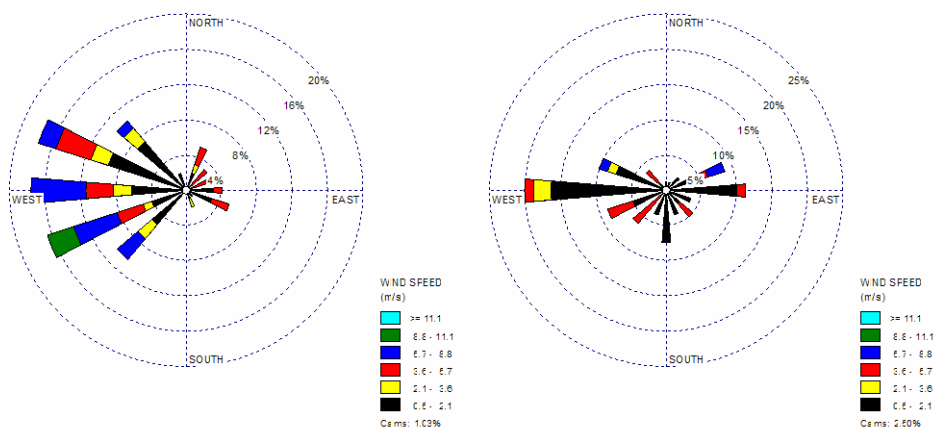


Figure 11. Wind Roses for High Wind PM-10 Exceedance Days (March 2005- March 2006) at West 43rd site: 11:00-17:00 (left) and 18:00-23:00 (right)

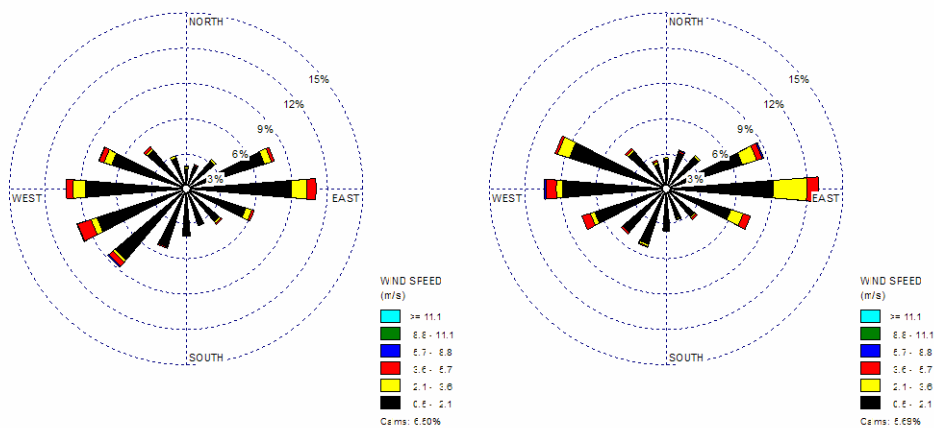


Figure 12. Wind Roses for Low PM-10 Days (March 2005-March 2006) at West 43rd site: 0:00-04:00 (left) and 05:00-10:00 (right)

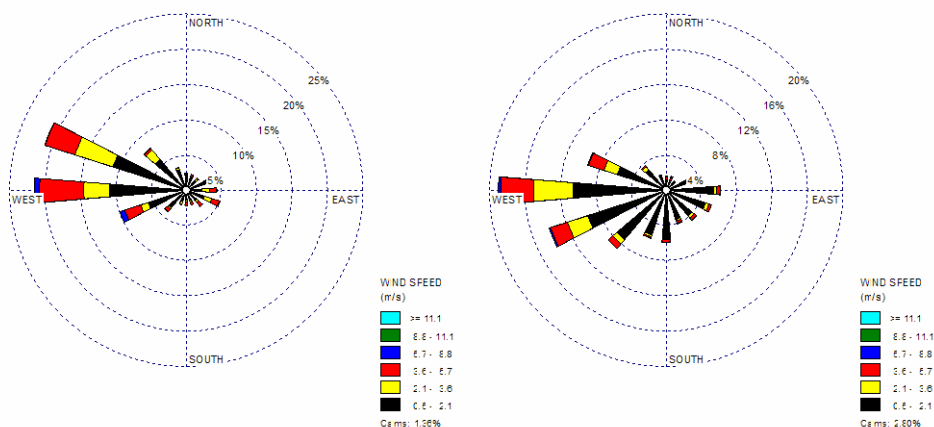


Figure 13. Wind Roses for Low PM-10 Days (March 2005-March 2006) at West 43rd site: 11:00-17:00 (left) and 18:00-23:00 (right)

1.5 Have there been any recent major changes in emissions of PM-10 in or near the nonattainment area? If so, what changes have occurred?

Periodic emissions inventories for PM-10 are prepared every three years by the Maricopa County Air Quality Department (MCAQD). Table 2 summarizes annual PM-10 emissions for the nonattainment area in 1994 and 2002 [5]. It can be concluded from this comparison that the point source emissions remain relatively constant and the onroad mobile source emissions are declining. The differences in 1994 and 2002 nonroad and area source emissions are obfuscated by shifts in the categorization of sources. However, the sum of the area and nonroad emissions is slightly higher in 2002 than 1994. The overall decrease in emissions may be explained by implementation of PM-10 control measures that between 1994 and 2002, that were part

of the Serious Area PM-10 Plan[4]. We are not aware of any significant changes in emissions of PM-10 in or near the nonattainment area since 2002.

Table 2. Summary of Annual PM-10 Emissions by Source Category for the PM-10 Nonattainment Area (tons/year)

Source Category	Periodic Emissions Inventory	Periodic Emissions Inventory
Year	1994	2002
Point	1,238	1,037
Area	10,460	23,086*
Nonroad Mobile	13,851	3,035**
Onroad Mobile	37,015	30,231
Total Emissions	62,564	57,389

*With windblown sources removed, because windblown dust was not included in the 1994 inventory.

**Adjusted to correct the error in aircraft emissions.

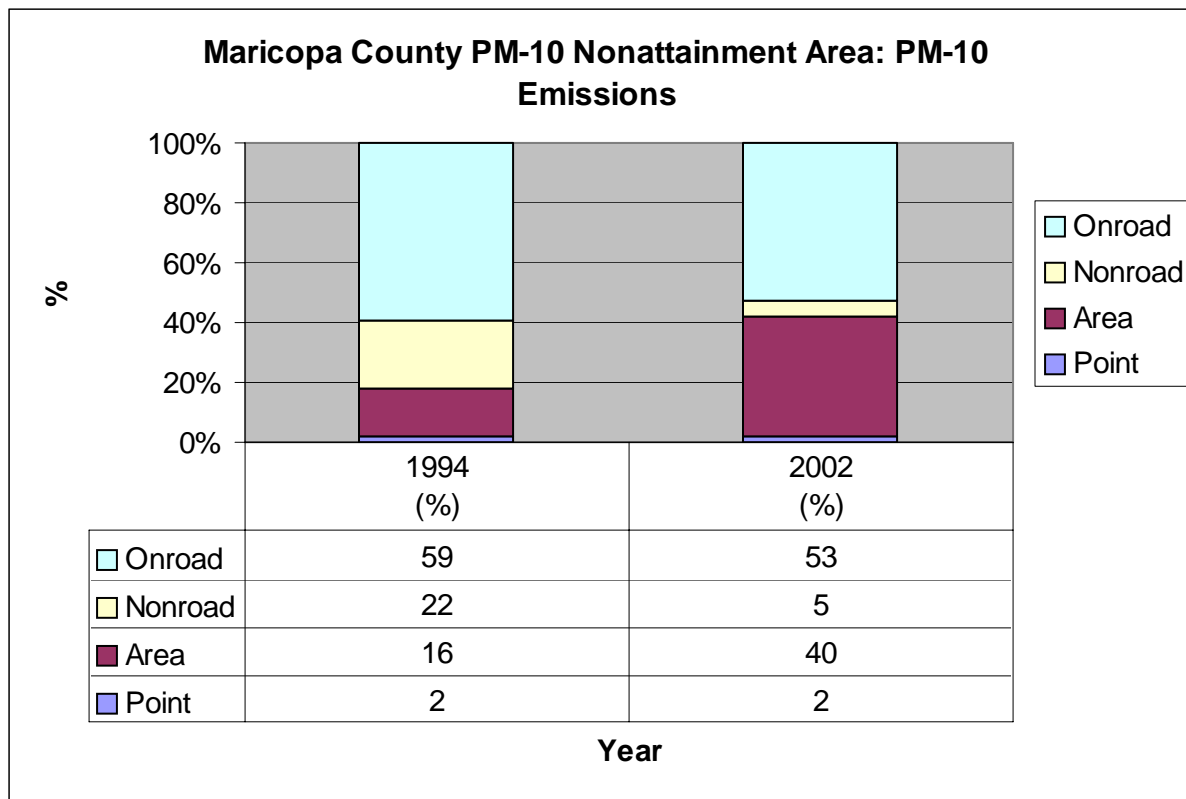


Figure 14. Summary of 1994 and 2002 PM-10 Emissions by Major Source Categories in Maricopa County PM-10 Nonattainment Area (tons/year)

1.6 Are there discernible trends in design values or other air quality indicators, which have accompanied a change in emissions?

Figure 15. shows the 2001-2005 trends in the highest 24-hour PM-10 average at monitoring sites in the PM-10 nonattainment area. In general, trends are similar over all sites, with relatively bad years in 2003 and 2005, and relatively “clean” years in 2001, 2002, and 2004. These trends seem to be largely due to meteorological conditions, e.g., level of annual precipitation and number of high wind days.

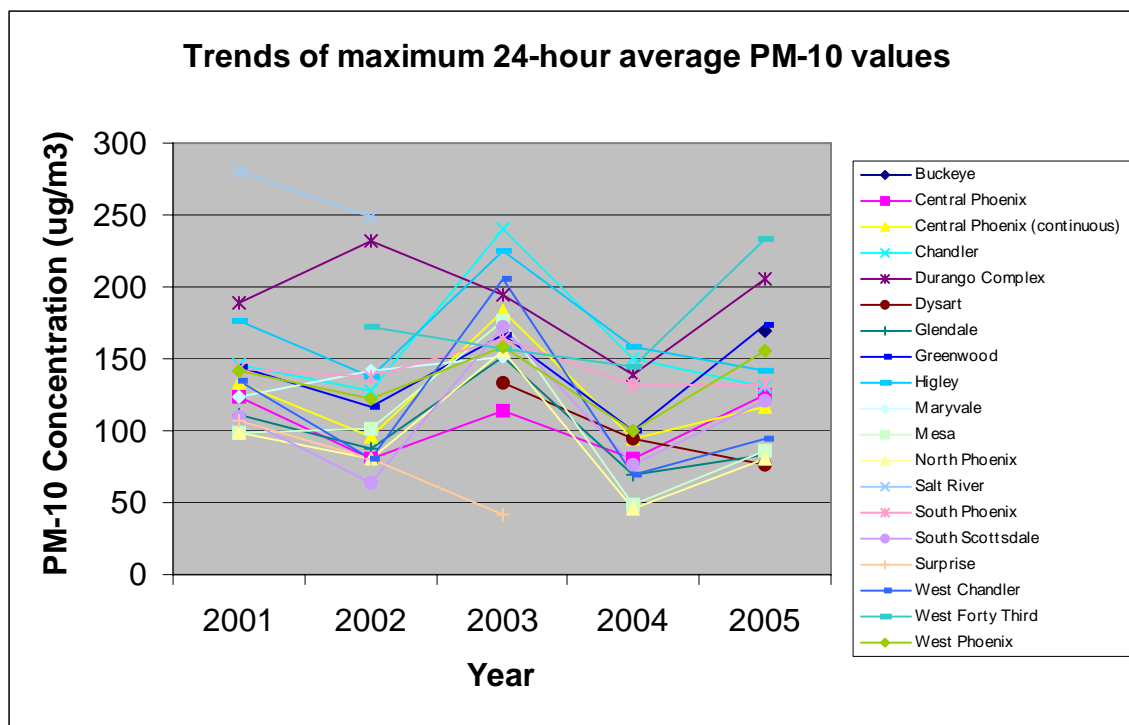


Figure 15. Trends in Maximum 24-hour Average PM-10 Values

1.7 is there any apparent spatial pattern to the trends in design values?

There are two apparent spatial patterns to the trends in design values when the area is divided into two different parts (north and south), as shown in Figure 16. (the blue line). Overall, sites to the south of this line violated the 24-hour PM-10 standard during the period 2001 through March 2006, while none of the sites to the north of the line exceeded the 24-hour PM-10 standard during this period.

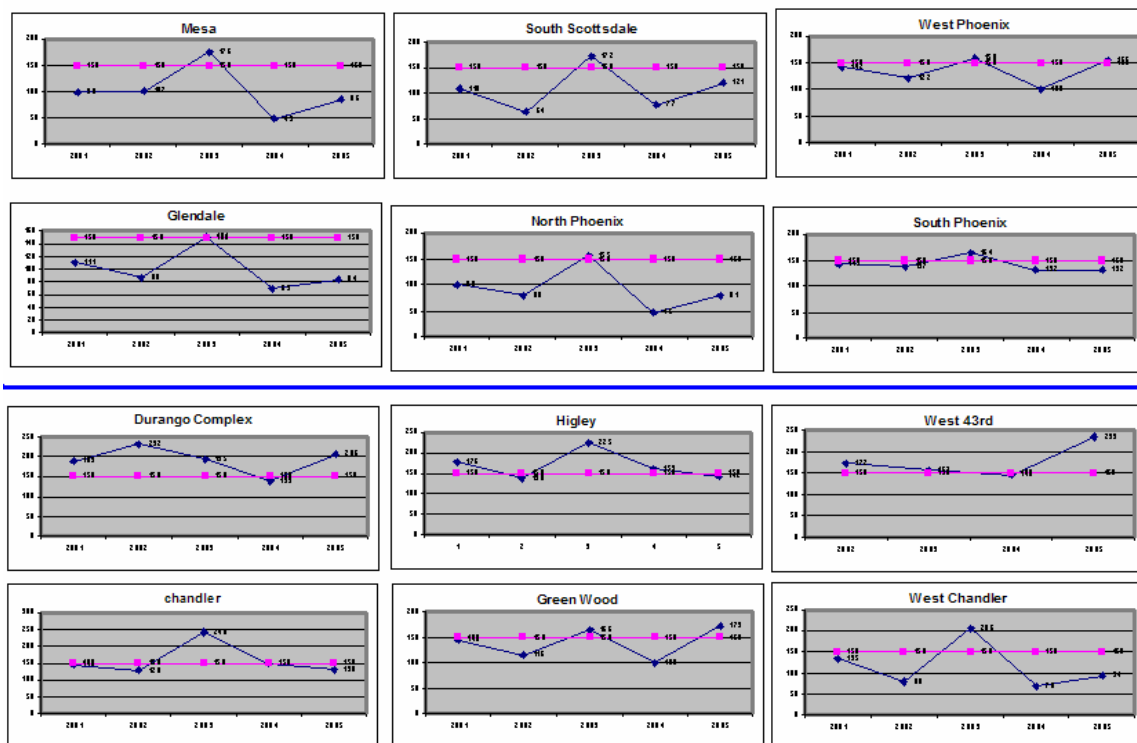
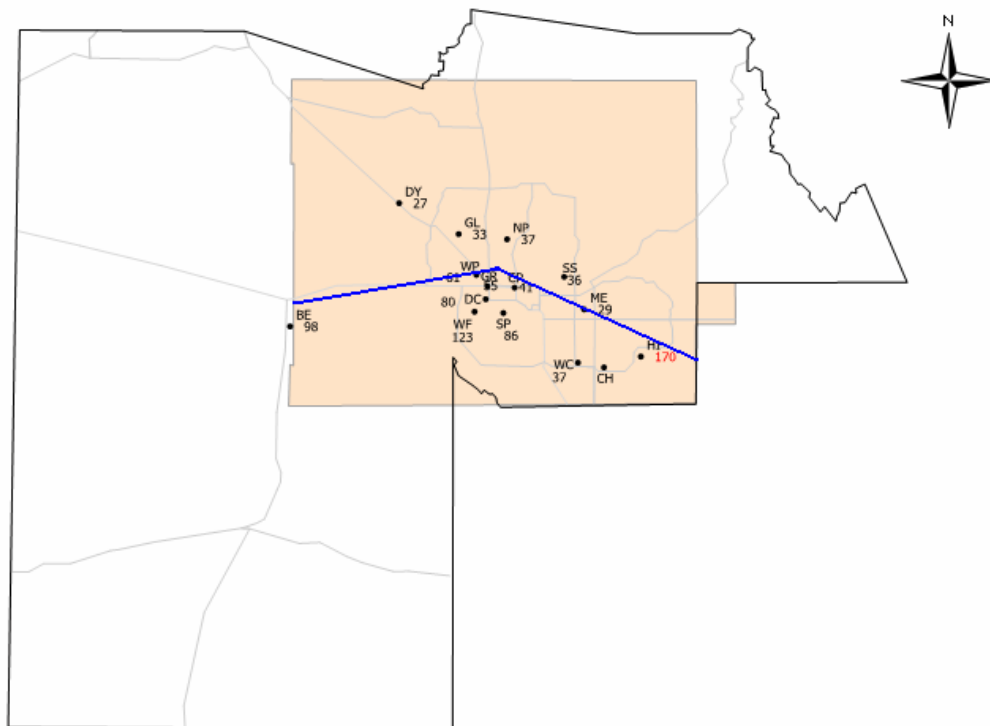


Figure 16. Spatially Distributed Trends of 24-hour PM-10 Highest Values at Maricopa County Monitoring Sites: 2001- March 2006

1.8 Is the nonattainment problem primarily a local one or are regional factors important?

To figure out if regional factors influence the problem in the PM-10 nonattainment area, it is useful to check if there are other nonattainment areas within one day's transport range. Figure 17. shows 24-hour PM-10 nonattainment area counties in the U.S. This figure indicates that the closest nonattainment areas are in southern Arizona and southern California. Analysis of 36-hour back trajectories confirms on the design days (See Attachment II), the PM-10 transport is limited primarily to local and intra-urban transport [6,7].

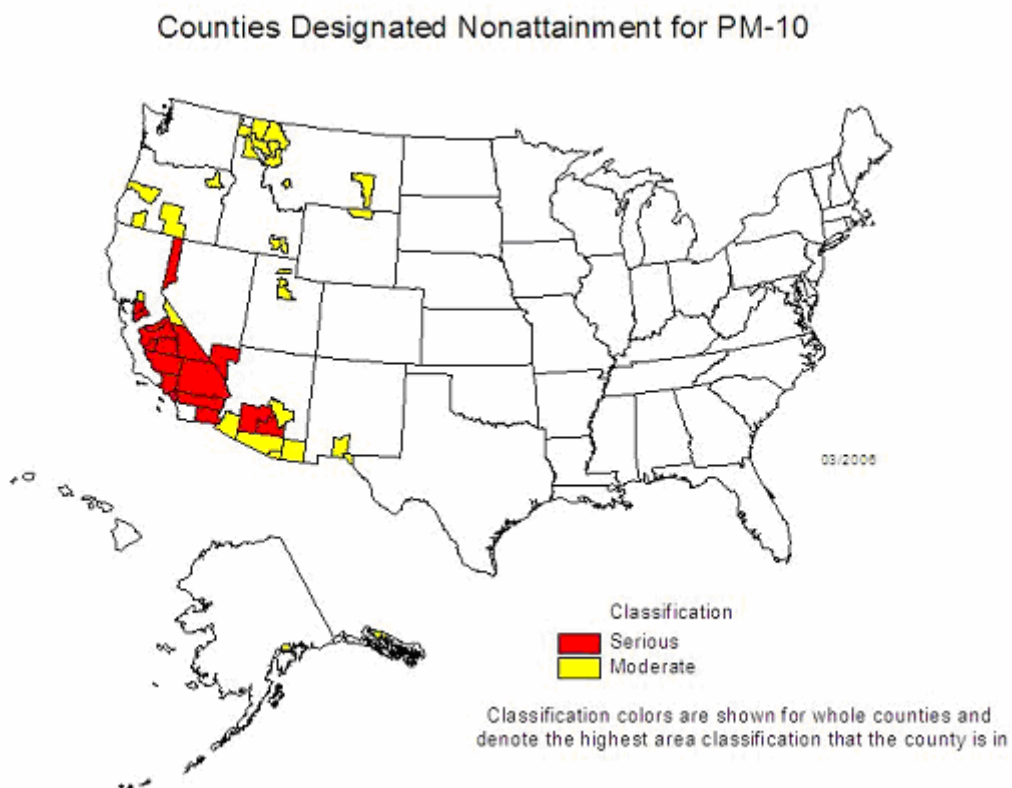


Figure 17. 24-Hour PM-10 Area County Map (source: U.S.EPA, <http://www.epa.gov/air/oaqps/greenbk/mapppm10.html>)

1.9 Are there any distinctive meteorological measurements at the surface or aloft which appear to coincide with occasions with 24-hour daily maxima greater than $154 \mu\text{g}/\text{m}^3$?

Identification and classification of high PM-10 days are based on high winds and low winds. The dependence of high PM-10 concentrations on meteorological parameters is explained in more detail in Attachment 1.

References

- [1] 2004 Network Review, Air Quality Division, Maricopa County Environmental Services Department, May 2005.
- [2] 2005 Network Review, Air Quality Division, Maricopa County Environmental Services Department, May 2006.
- [3] Data obtained from Ronald Pope, Air Monitoring Data Coordinator, Maricopa County Air Quality Department, March 2006.
- [4] Revised MAG 1999 Serious Area Particulate Plan for PM-10 for the Maricopa County Nonattainment Area, Maricopa Association of Governments, February 2000.
- [5] 2002 Periodic Emission Inventory for PM-10, Maricopa County Air Quality Department, Revised March 2006.
- [6] Modeling of episodic particular matter events using a 3-D air quality model with fine grid: Applications to a pair of cities in the U.S./Mexico border , Yu-Jin Choi*, Peter Hyde +, and H. J. S. Fernando*, *Environmental Fluid Dynamics Program, Department of Mechanical and Aerospace Engineering, Arizona State University, Tempe, AZ 85285, +Arizona Department of Environmental Quality, Phoenix, AZ 85102, USA, Submitted to Atmospheric Environment, November 15, 2005.
- [7] Revised PM-10 State Implementation Plan for the Salt River Area, Technical Support Document, Air Quality Division, Arizona Department of Environmental Quality, June 2005.